

Claims

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- [c1] 1. An improved operation of disk drive read-ahead (pre-buffering) logic implementing the immediate fetching of data after completing any seek operation, without waiting or skipping sectors coming before the sector addressed by the operation requiring a seek, if any.
- [c2] 2. An improved operation of disk drive reading and writing technology implementing simultaneous reads and writes on plurality of data surfaces, whatever the data surfaces are for the cylinder where the used heads are, whatever data organization is used and whatever above-mentioned way of achieving precise positioning of all heads at the same time is used.
- [c3] 3. An improved operation of claim 2 wherein the order of recorded data (data sectors) is reorganized to be ordered first by surfaces, then by cylinder/track sectors, then by cylinders unlike prior-art ordering by track/cylinder sectors, then by surfaces, then by cylinders.
- [c4] 4. An improved operation of claim 2 wherein additional control information (such as parity) is stored along with raw data (such as on separate control data surface(s), allowing for control data surfaces to be different for different cylinders and sectors) allowing correct disk reads and writes of any sector even if one or more surfaces of said sector is inaccessible for any reason (such as surface damage or head failure).
- [c5] 5. An improved operation of claim 2 wherein each smallest addressable chunk of data (data sector) is stripped to a plurality (two or more) of data surfaces, whatever the data surfaces are for the cylinder where the used heads are.
- [c6] 6. An improved operation of claim 5 wherein additional control information (such as parity) is stored along with raw data (such as on separate control data surface(s), allowing for control data surfaces to be different for different cylinders and sectors) allowing correct disk reads and writes of any data sector of data even if one or more surfaces of said data sector is inaccessible for any reason (such as surface damage or head failure).
- [c7] 7. An improved operation of claim 6 wherein the disk drive system interface

and/or supported command/communication protocol is/are capable of informing the host system of the error or failure condition handled by the improvement of claim 6 .

[c8] 8. An improved disk drive system comprising of more than one read/write head or head pair for every surface, being or not being independent of each other, limited or not limited to being on the same cylinder at the same time and being or not being on the same head arm or actuator, limited or not limited to being on the same zone at the same time, whether the heads have fixed positions or not, whatever the total number of heads or heads per arm is used, whatever the implementation, technology, materials or manufacturing process is used for any single component of the said system and whether all or only some heads are capable of either reading or writing data.

[c9] 9. An improved operation reading and writing logic of disk drive system of claim 8 implementing simultaneous reads and writes on plurality of data surfaces, whatever the data surfaces are for the cylinder where the used heads are.

[c10] 10. An improved operation of claim 8 wherein the order of recorded data is reorganized to be ordered first by surfaces, then by track/cylinder sectors, then by cylinders unlike prior-art ordering by track/cylinder sectors, then by surfaces, then by cylinders.

[c11] 11. An improved operation of claim 8 wherein additional control information (such as parity) is stored along with raw data (such as on separate control data surface(s), allowing for control data surfaces to be different for different cylinders and sectors) allowing correct disk reads and writes of any sector even if one or more surfaces of said sector is inaccessible for any reason (such as surface damage or head failure).

[c12] 12. An improved operation of claim 8 wherein each smallest addressable chunk of data (data sector) is stripped to a plurality (two or more) of data surfaces, whatever the data surfaces are for the cylinder where the used heads are.

[c13] 13. An improved operation of claim 8 , or alternatively the claims 9 , 10 , 11 or 12 wherein the controller of the said disk drive system is capable of handling

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the situation when one or more heads or head pairs fail, as long as there is at least one working head (or one working read and one working write head) per surface (and per zone if heads are assigned to zones).

[c14] 14. An improved operation of claim 12 , or alternatively the claim 13 , wherein additional control information (such as parity) is stored along with raw data (such as on separate control data surface(s), allowing for control data surfaces to be different for different cylinders and sectors) allowing correct disk reads and writes of any sector of data even if one or more surfaces of said sector is inaccessible for any reason (such as surface damage or head failure).

[c15] 15. An improved operation of claim 13 , or alternatively the claim 14 , wherein the disk drive system interface and/or supported command/communication protocol is/are capable of informing the host system of the error or failure condition handled by the improvement of said claim.

[c16] 16. An improved operation of claim 8 or, alternatively, claims 9 , 10 , 11 , 12 , 13 , 14 or 15 , wherein the disk drive system interface and/or supported command/communication protocol is/are capable of accepting future operation profile information from the host system, for the purpose of optimizing the operation of the disk drive system (most importantly, movement of head arms).

[c17] 17. An improved operation of claim 8 or, alternatively, claims 9 , 10 , 11 , 12 , 13 , 14 , 15 or 16 , wherein the disk drive system interface and/or protocol is/are supported command/communication capable of accepting a plurality of commands from one host and/or more clients by queuing them, optimizing the operation of the disk drive system and being able to reorder the execution of these commands.

[c18] 18. An improved operation of claim 17 wherein the disk drive system interface and/or supported command/communication protocol is/are capable of simultaneously receiving new commands and new data and sending any requested data back to any host or client, limited or not limited to supporting two-way communication only with one host or client at a time, limited or not limited to supporting the two-way communication with two different

hosts/clients at a time only.

[c19]

19. A way of achieving the fine-positioning of hard disk drive heads by means of additional piezo-electric effect driven mechanism mounted on main (base) actuator arms for the purpose of achieving either faster head positioning time or local head movemenet independece or both.

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